

# Metal and Nonmetal National Mine Rescue Contest — Gas Test Instruments



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U. S. Department of Labor  
Mine Safety and Health Administration

2000



# **Metal and Nonmetal National Mine Rescue Contest — Gas Test Instruments**

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## PRELIMINARY CHECKS OF GAS DETECTORS AND MEASURING DEVICES



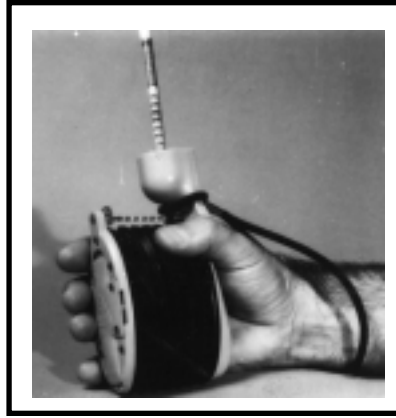
CSE CORPORATION  
MODEL 102 DIGITAL METHANE DETECTOR

### **Preliminary checks:**

(1) Place strap over your wrist. (2) Check battery charge: press test button at right side of case and battery check switch at left side of case, simultaneously. Hold both switches for 15 seconds. If the battery is at operating level, display digits will light and read 3.0 to 4.5 volts. At 3.3 it should be charged. (3) Check zero: press test button. A reading of 0.0 and 0.1 should appear within 7 seconds. If (MALF) comes on and flashes, do not use. If (MALF) comes on and stays on, do not use. (Problem is with the main circuit board.)

### **Testing for methane:**

(1) Hold at sampling point. (2) Depress test button and hold depressed until display is illuminated and stable. This usually takes about 7 seconds. Note methane reading and release button.



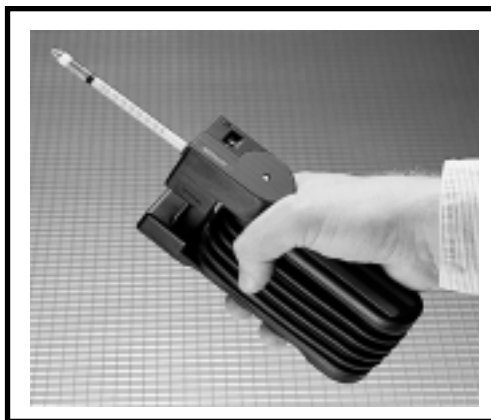
DRAEGER SAFETY, INC.  
MULTI-GAS DETECTOR

**Preliminary checks:**

(1) The pump should be checked for airtightness before each use. (2) This is done by closing the suction opening of the pump head with an unopened tube and compressing the bellows. If the bellows has not opened in 10 minutes, the pump is airtight.

**Operation:**

(1) Break off both ends for the Draeger tube in the ampoule breaker eyelet of the pump or in the breakoff husk by a rotation motion. (2) Tightly insert the Draeger tube in the pump head with the arrow pointing towards the pump. (3) Take the pump in the bellows as far as the stop. (4) Suction will be automatic and is completed when the chain is at full tension. (5) The number of strokes prescribed for the various Draeger tubes must be followed for each test.



DRAEGER SAFETY, INC.  
ACCURO MULTI-GAS DETECTOR

**Preliminary checks:**

The pump should be checked for air tightness before each use. This is done by inserting an unopened Draeger-Tube into the opening of the pump head. The pump must be compressed completely. If the bellows has not opened completely in 15 minutes, the pump is air tight.

**Operation:**

Break off both ends of the Draeger-Tube by scoring the ends in the integral ceramic element on the pump and snapping off the ends or using the Deluxe tube opener. Tightly insert the Draeger-Tube in the pump head with the arrow pointing towards the pump. Compress the bellows completely, actuating the stroke counter. The suction process will be initiated and is complete when the white end-of-stroke indicator pops up.

The number of strokes prescribed for the various Draeger-Tubes must be followed for each test.



DRAEGER SAFETY, INC.  
CMS SPOT GAS DETECTOR

**Preliminary checks:**

Move blue sliding switch to position 1: Four black battery symbols indicate approximately 450 minutes of measurement time. One black (filled) battery symbol with 3 empty symbols indicates batteries **must** be replaced.

**Operation:**

Slide switch to position 1, function test is performed. Follow instructions given in display. **WAIT** for “load chip” prompt. Insert chip into bottom of analyzer with arrow pointing toward inlet. Chip type is indicated and “start 2 ↓.” Move slide switch to position 2. Leak test is conducted. Follow prompt in display. Move to position 3, measurement is conducted. The result is given in the display. Result may be stored in the data recorder.





DRAEGER SAFETY, INC.  
PAC III SINGLE GAS PERSONAL MONITOR

**Checking the Instrument:**

1. Visually inspect the instrument for damage.
2. Turn the instrument on by pressing the large enter key.
3. Check the instrument battery voltage by pressing the enter button to scroll through the screens depicting concentration, alarms, and battery life. The actual voltage of the battery is displayed on the screen.
4. After power-on, the instrument will go through a warm-up period. The Pac III is capable of detecting 30+ toxic gases and oxygen.
5. Ensure the instrument is free of warnings and faults. When the instrument warm-up is complete, display icons may appear indicating a need for further inspection. Be sure that the "i" icon and the "lightning bolt" are not visible in the screen. If they are visible, enter the menu by depressing the large button for 3-5 seconds and enter the Daily Use menu. In the Daily Use menu you can check Warnings and Errors.

**Testing for Hazardous Gases:**

1. Ensure the instrument is turned on and functioning without errors (no lightning bolt). Place or hold the instrument in the area to be monitored.
2. Once the gas display reading has stabilized, record the LCD readout.
3. User selectable alarm limits will indicate when the gas levels have exceeded this limit. The alarms are visual and audible with bright LED's and a loud horn.
4. If you have further operating or calibration questions or concerns, please refer to the Instructions for Use Manual.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
MODEL CD210 DIGITAL METHANOMETER

**Checking instrument:**

1. Visually check instrument for external damage.
2. Check the battery voltage by depressing the display button on the side of the case. The display should light and the low battery LED should not be lit. If the low battery LED lights or begins to blink, there are approximately 20 checks remaining.
3. Depress the "DISPLAY" button on the side of the case. The display should indicate -00.0, 00.0 or 00.1 percent.

**Testing for methane:**

1. Place instrument into area to be tested.
2. Depress the "DISPLAY" button and wait for the display to stabilize. (Normal response time is 5 to 10 seconds.)
3. Read the display for percent of methane.
4. Remove instrument.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
MODEL CD21 2 CONTINUOUS METHANE MONITOR

**Checking instrument:**

1. Turn unit on by backing off knurled knob and inverting calibration cover. Tighten knurled knob. (Do this prior to starting the clock for the working of the contest problem.)
2. Visually inspect the digital display. The display should indicate -00.1, 00.0, or 00.1 percent. If the display is blanked out and a "1" with an arrow pointing at the words "LOW BATT" appear, the instrument should not be used.

**NOTE:** The sealed button on the side of the case is for backlighting the display and serves no other purpose.

**Testing for methane:**

1. Make sure the instrument has been turned on and place it in the area to be tested.
2. Wait for the reading to stabilize and note the methane content shown on the display. An alarm will sound when the methane content exceeds 1 percent or at the percent the user has chosen.
3. Remove instrument.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
MODEL OX231 OXYGEN MONITOR

**Checking instrument:**

1. Turn unit on by backing off knurled knob and inverting calibration cover. Tighten knurled knob. (Do this prior to starting the clock for the working of the contest problem.)

**NOTE:** The sealed button on the side of the case is for backlighting the display and serves no other purpose.

2. Visually check instrument for damage.
3. To check battery, observe the display and see if the words "LO BAT" appear in the upper left corner. If they do, there are approximately 20 hours of battery life remaining and the instrument operates properly during these 20 hours. If the unit is used beyond this time, the alarm sounds continuously; the display is blanked out except for a "1" and a red LED will appear in the lower left corner of the display. When this occurs, the instrument cannot be used until the batteries are replaced.

**Testing for oxygen:**

1. Place instrument into area to be tested. Hold in area for 10 to 15 seconds and note reading on the display. (Instrument operates continuously. A 10 to 15 second period is only necessary in test boxes.) An alarm will sound if the oxygen level falls below 19.5 percent or at the percent the user has chosen.
2. Remove instrument.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
MODEL CO260 CARBON MONOXIDE INDICATOR

**Checking instrument:**

1. Turn unit on by backing off knurled knob and inverting calibration cover. Tighten knurled knob. (Do this prior to starting the clock for the working of the contest problem.)

**NOTE:** The sealed button on the side of the case is for backlighting the display and serves no other purpose.

2. Visually check instrument for damage.
3. To check battery, observe the display and see if the words "LO BAT" appear in the upper left corner. If they do, there are approximately 20 hours of battery life remaining and the instrument operates properly during these 20 hours. If the unit is used beyond this time, the alarm sounds continuously; the display is blanked out except for a "1" and a red LED will appear in the lower left corner of the display. When this occurs, the instrument cannot be used until the batteries are replaced.

**Testing for carbon monoxide:**

1. Place instrument into area to be tested. Hold in area for 10 to 15 seconds and note reading on the display. (Instrument operates continuously. A 10 to 15 second period is only necessary in test boxes.) An alarm will sound if the carbon monoxide content exceeds 50 ppm or at the level the user has chosen.
2. Remove instrument.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
MODEL MX240 COMBINATION  
OXYGEN/METHANE GAS MONITOR

**Checking instrument:**

1. Turn unit on by backing off knurled knob and inverting calibration cover. Tighten knurled knob. (Do this prior to starting the clock for the working of the contest problem.)
2. Visually inspect the digital display. The oxygen content should be approximately 20.9 percent.
3. Depress the "DISPLAY" button on the side of the case. The display should indicate -00.1, 00.0 or 00.1 percent. If the display is blanked out except for a "1" with an arrow pointing at the words "LOW BATT" appears, the instrument should not be used.

**Testing for methane/oxygen:**

1. Make sure the instrument has been turned on and place it in the area to be tested.
2. When reading has stabilized, note the oxygen shown on the display. An alarm will sound if the content falls below 19.5 percent or at the percent the user has chosen.

3. Depress the methane display button on the side of the instrument. The methane content will appear on the display, note reading. An alarm will sound when the methane content exceeds 1 percent or at the percent the user has chosen.

**NOTE:** If an instrument carrying MSHA approval number 8C-53-0 is exposed to concentrations of methane greater than 3 percent, the display will blank out and a “1” will appear. This will erase itself once the methane content falls below 3 percent. An instrument carrying MSHA approval number 8C-53-1 will not blank out when the methane concentration exceeds 3 percent. It will continue to measure methane concentrations above 3 percent.

4. Remove instrument.





INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
TMX412 MULTI-GAS MONITOR

**Checking the instrument:**

1. Turn the instrument on by pressing the MODE Button and hold until "Release" appears on the display. The MODE button is located on the bottom of the instrument between the red LED's. (Do this prior to starting the clock for working the contest problem.)
2. Visually check the instrument for any damage.
3. After turning the instrument on, the unit goes through a warm-up sequence in which the display is completely activated and then the installed sensors are displayed. The TMX412 is capable of various sensor configurations. Operators can choose from oxygen, LEL or methane, and one or two of the following toxic gases: carbon monoxide, hydrogen sulfide, sulfur dioxide, nitrogen dioxide or chlorine.
4. When the instrument completes the warm-up sequence it will display the current concentration of gas of the installed sensors. In clean air the following content of gas should be observed: oxygen is approximately 20.9% +/- 0.1%. The methane display should read -0.1, 0.0, or 0.1. The toxic gas should read -001, 000, or 001 for carbon

monoxide and hydrogen sulfide and -00.1, 00.0, or 00.1 for sulfur dioxide, nitrogen dioxide and chlorine.

5. Check the battery condition. There is an asterisk (\*) on the display which indicates batter life. Each segment indicates approximately one hour of run time.

**Testing for hazardous gases:**

1. Make sure the instrument is turned on and functioning properly. Place the instrument in the area to be monitored.
2. The TMX412 will display up to four gases simultaneously. Once the gas reading shave stabilized, note the content of gas as displayed by the chosen sensor.
3. The TMX412 has factory alarm settings which are consistent with MSHA guidelines and units will alarm when gas levels exceed these limits. Alarm settings are resettable and the unit will alarm at the user chosen values.
4. Refer to the instruction manual for further operating and calibration information.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
LTX310 MULTI-GAS MONITOR

**Checking the instrument:**

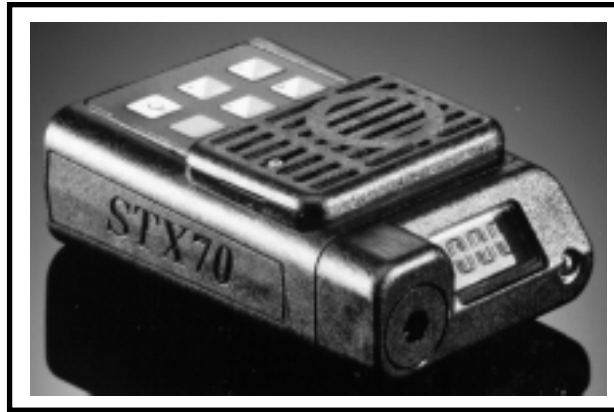
1. Turn on the instrument by pressing and holding the On/Off key until "Release" appears on the display. The On/Off Key is located on the faceplate of the instrument. (Do this prior to starting the clock for working the contest problem.)
2. Visually check the instrument for any damage.
3. After turning the instrument on, the unit goes through a warm-up sequence in which the display is completely activated and then the installed sensors are displayed. The LTX310 is capable of various sensor configurations. Operators can choose from oxygen, LEL or methane, and one of the following toxic gases: carbon monoxide, hydrogen sulfide, sulfur dioxide, nitrogen dioxide, chlorine, hydrogen cyanide, nitric oxide and ammonia.
4. When the instrument completes the warm-up sequence it will display the current concentration of gas of the installed sensors. In clean air the following content of gas should be observed: oxygen is approximately 20.9% +/- 0.1%. The methane display should read -0.1, 0.0, or 0.1. The toxic gas should read 0001, 000, or 001 for carbon

monoxide, hydrogen sulfide, hydrogen cyanide, nitric oxide and ammonia and -00.1, 00.0, or 00.1 for sulfur dioxide, nitrogen dioxide, and chlorine.

5. Check the battery condition. There is an asterisk (\*) on the display which indicates battery life. Each segment indicates approximately one hour of run time.

**Testing for hazardous gases:**

1. Make sure the instrument is turned on and functioning properly. place the instrument in the area to be monitored.
2. The LTX310 will display up to three gases simultaneously. Once the gas reading have stabilized, note the content of gas as displayed by the chosen sensor.
3. The LTX310 has factory alarm settings which are consistent with MSHA guidelines and units will alarm when gas levels exceed these limits. Alarm setting are resettable and the unit will alarm at the user chosen values.
4. Refer to the instruction manual for further operating and calibration information.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
STX70 PERSONAL GAS MONITOR

**Checking the instruments:**

1. Turn on the instrument by pressing and holding the “blue” function key and the “On” key simultaneously. The operation keys are located above the sensor on the front of the instrument. (Do this prior to starting the clock for working the contest problem.)
2. Visually check the instrument for any damage.
3. After turning the instrument on, the unit goes through a warm-up sequence. The STX70 is capable of detecting oxygen or one of the following toxic gases: carbon monoxide, hydrogen sulfide, sulfur dioxide, nitrogen dioxide, chlorine, hydrogen cyanide, nitric oxide and ammonia.
4. When the instrument completes the warm-up sequence it will display the current concentration of gas of the installed sensor. In clean air the following content of gas should be observed: oxygen is approximately 20.9% +/- 0.1%. The toxic gas should read -001, 000, or 001 for carbon monoxide, hydrogen sulfide, hydrogen cyanide, nitric oxide and ammonia and -00.1, 00.0, or 00.1 for sulfur dioxide, nitrogen dioxide, and chlorine.

5. Check the battery condition. Press the mode key “M” once. The gas identifier screen appears. Press the “+” key once and the “BATT” screen appears. Press the “E” key and battery status is displayed. If four, three, or two asterisks (\*) appear the instrument will function properly. If only one (\*) appears replace the two batteries as soon as possible.

**Testing for hazardous gases:**

1. Make sure the instrument is turned on and functioning properly. Place the instrument in the area to be monitored.
2. The STX70 will display one gas. Once the gas reading has stabilized, note the content of gas as displayed by the chosen sensor.
3. The STX70 has factory alarm settings which are consistent with MSHA guidelines and units will alarm when gas levels exceed these limits. Alarm settings are resettable and the unit will alarm at the user chosen values.
4. Refer to the instruction manual for further operating and calibration information.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
LD322 COMBUSTIBLE GAS MONITOR

**Checking the instrument:**

1. Turn on the instrument by pressing and holding the On/Off Key until "Release" appears on the display. The On/Off Key is located on the faceplate of the instrument. (Do this prior to starting the clock for working the contest problem.)
2. Visually check the instrument for any damage.
3. After turning the instrument on, the unit goes through a warm-up sequence in which the display is completely activated and then the selected sensor is displayed. The LD322 is capable of detecting in either LEL or percent by volume methane.
4. When the instrument completes the warm-up sequence it will display the current concentration of gas. In clean air the following content of gas should be observed: methane display should read -0.1, 0.0, or 0.1.
5. Check the battery condition. There is an asterisk (\*) on the display which indicates battery life. Each segment indicates approximately one hour of run time.

**Testing for hazardous gases:**

1. Make sure the instrument is turned on and functioning properly. Place the instrument in the area to be monitored.
2. The LD322 will display combustible gases in LEL or methane. Once the gas reading has stabilized, note the content of gas as displayed for the sensor.
3. The LD322 has factory alarm settings which are consistent with MSHA guidelines and units will alarm when gas levels exceed these limits. Alarm settings are resettable and the unit will alarm at the user chosen values.
4. Refer to the instruction manual for further operating and calibration information.





INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
MODEL CMX270 COMBINATION OXYGEN/  
METHANE/CARBON MONOXIDE GAS MONITOR

**Checking the instrument:**

1. Turn the unit on by backing off the knurled knob and rotating the calibration cover one half turn. Tighten the knurled knob. (Do this prior to starting the clock for the working of the contest problem.)
2. Visually inspect the digital display. The oxygen content should be approximately 20.9%.
3. Depress and release the CO (carbon monoxide) button on the instrument's faceplate. The display should read -001, 000, or 001 ppm.
4. Depress and release the CH<sub>4</sub> (methane) button on the instrument's faceplate. The display should read -00.1, 00.0, or 00.1 percent. If the display is blanked and the words "LOBAT" appear in the upper left corner of the display, the instrument's battery is low and the instrument should not be used until the battery is recharged.

**Testing for oxygen/methane/carbon monoxide:**

1. Make sure the instrument has been turned on and place it in the area to be tested.
2. When the oxygen reading has stabilized, note the oxygen content shown on the display. Audible and visual alarms will be activated when the oxygen content falls below 19.5% or rises above 23.0% or at the values chosen by the user.
3. Depress and release the CH<sub>4</sub> (methane) button. A methane reading will appear on the instrument's display, note this reading. Audible and visual alarms will be activated when methane content exceeds 1.0% or at the percent the user has chosen.
4. Depress and release the CO (carbon monoxide) button. A carbon monoxide reading will appear on the instrument's display, note this reading. Audible and visual alarms will be activated when methane content exceeds 50 ppm or at the ppm level the user has chosen.
5. Remove the instrument.
6. Refer to the instruction manual for further operating and calibration information.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
MODEL CO262 CARBON MONOXIDE MONITOR

**Checking the instrument:**

1. Turn the unit on by backing off the knurled knob and rotating the calibration cover one half turn. Tighten the knurled knob. (Do this prior to starting the clock for the working of the contest problem.) Note: The sealed button on the side of the case is for back lighting the display and serves no other purpose.
2. Visually check the instrument for damage.
3. To check battery, observe the display and see if the words "LOBAT" appear in the upper left corner. If it does, there are 20 hours or less of battery life remaining. During this time the instrument will operate properly. If a unit goes beyond the 20 hours, the display will blank out except for a 1 in the far left side of the display and the audible and visual alarm will be activated. When this condition occurs the unit cannot be used until the batteries are replaced.

**Testing for carbon monoxide:**

1. Place the instrument into the area to be tested. Hold instrument in the area for 10 to 15 seconds and note the reading on the display. (Instrument operates continuously. A 10 to 15 second period is only necessary in test boxes.) An alarm will sound if the carbon monoxide content exceeds 50 ppm or at the level the user has chosen.
2. Remove the instrument.
3. Refer to the instruction manual for further operating and calibration information.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
MODEL NO268 NITROGEN DIOXIDE MONITOR

**Checking the instrument:**

1. Turn the unit on by backing off the knurled knob and rotating the calibration cover one half turn. Tighten the knurled knob. (Do this prior to starting the clock for the working of the contest problem.) Note: The sealed button on the side of the case is for back lighting the display and serves no other purpose.
2. Visually check the instrument for damage.
3. To check battery, observe the display and see if the words "LOBAT" appear the upper left corner. If it does, there are 20 hours or less of battery life remaining. During this time the instrument will operate properly. If a unit goes beyond the 20 hours, the display will blank out except for a 1 in the far left side of the display and the audible and visual alarm will be activated. When this condition occurs the unit cannot be used until the batteries are replaced.

**Testing for nitrogen dioxide:**

1. Place the instrument in the area to be tested. Hold instrument in the area for 25 to 30 seconds and note the reading on the display. (Instrument operates continuously. A 25 to 30 second period is only necessary in test boxes.) An alarm will sound if the nitrogen dioxide content exceeds 1.0 ppm or at the level the user has chosen.
2. Remove the instrument.
3. Refer to the instruction manual for further operating and calibration information.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
MODEL MX250 COMBINATION  
OXYGEN/METHANE GAS MONITOR

**Checking the instrument:**

1. Turn the unit on by backing off the knurled knob and rotating the calibration cover one half turn. Tighten the knurled knob. (Do this prior to starting the clock for the working of the contest problem.)
2. Visually inspect the digital display. The oxygen content should be approximately 20.9%.
3. Depress and release the CH<sub>4</sub> (methane) button on the instrument's faceplate. The display should read -00.1, 00.0, or 00.1 percent. If the display is blanked and the words "LOBAT" appear in the upper left corner of the display, the instrument's battery is low and the instrument should not be used until the battery is recharged.

**Testing for oxygen/methane:**

1. Make sure the instrument has been turned on and place it in the area to be tested.
2. When the oxygen reading has stabilized, note the oxygen content shown on the display. Audible and visual alarms will

be activated when the oxygen content falls below 19.5% or rises above 23.0% or at the values chosen by the user.

3. Depress and release the CH<sub>4</sub> (methane) button. A methane reading will appear on the instrument's display, note this reading. Audible and visual alarms will be activated when methane content exceeds 1.0% or at the percent the user has chosen.
4. Remove the instrument.
5. Refer to the instruction manual for further operating and calibration information.





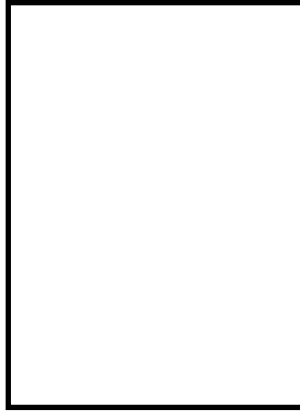
INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
MODEL TMX410 MULTI-GAS MONITOR

**Checking the instrument:**

1. Turn the unit on by loosening the knurled knob and rotating the calibration cover one quarter turn. The on-off switch is located under the calibration cover. The TMX410 is turned on by moving the switch (left) to the on position. (Do this prior to starting the clock for working the contest problem.)
2. Visually check the instrument for damage.
3. At turn on, the unit goes through a warm-up sequence in which battery status and sensor identification are revealed. The TMX410 can accommodate various sensor combinations. Operators can choose from oxygen, LEL or methane, and one or two of the following toxic gases: carbon monoxide, hydrogen sulfide, sulfur dioxide, nitrogen dioxide, and chlorine.
4. The oxygen content should be approximately 20.9%.  
The methane display should read -00.1, 00.0, or 00.1 percent.  
The toxic display(s) should read -001, 000, 001 ppm for carbon monoxide, hydrogen sulfide and -00.1, 00.0, or 00.1 ppm for sulfur dioxide, nitrogen dioxide, and chlorine.

**Testing for hazardous gases:**

1. Make sure the instrument has been turned on and place it in the areas to be monitored.
2. The TMX410 displays up to four sensor outputs simultaneously. Once the gas readings have stabilized, note the content of gas as read by the chosen sensors.
3. The TMX410's factory alarm settings are consistent with MSHA guidelines and units will alarm when gas levels exceed these limits. Alarm settings are resettable and the unit will alarm at the user chosen values.
4. Refer to the instruction manual for further operating and calibration information.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
LTX311 GAS MONITOR

**Checking the instrument:**

1. Turn the instrument on by pressing the ON OFF MODE Button and holding until “RELEASE” appears on the display. The ON OFF MODE key is located on the faceplate of the instrument. (Do this prior to the start of the clock for working contest problems.) **NOTE:** *If the ON OFF MODE Button is released prior to the completion of the 5 second delay, the instrument start up will be aborted and the LTX311 will turn off.*
2. Visually check the instrument for any damage.
3. After turning the instrument on, the unit goes through a warm-up sequence in which the display is completely activated and then the installed sensors are displayed. The LTX311 is capable of various sensor configurations. Operators can choose from Oxygen, LEL or Methane, and one of the following toxic gases: Carbon Monoxide, Hydrogen Sulfide, Sulfur Dioxide, Nitrogen Dioxide and Hydrogen Cyanide.
4. When the instrument completes the warm-up sequence it will display the current concentration of gas of the in-

stalled sensors. In clean air, the following content of gas should be observed: Oxygen is approximately 20.9% +/- 0.1%. The Methane display should read -0.1, 0.0 or 0.1%. The toxic gas should read -001, 000, 001 PPM for Carbon Monoxide, Hydrogen Sulfide, and Hydrogen Cyanide and -00.1, 00.0, 00.1 for Nitrogen Dioxide and Sulfur Dioxide.

5. Check the battery condition by observing the asterisk on the display, which indicates battery life. Each segment represents approximately one hour of instrument run time.

**Testing for hazardous gases:**

1. Make sure the instrument is turned on and functioning properly. Place the instrument in the area to be monitored.
2. The LTX311 will display up to three gases simultaneously. Once the gas readings have stabilized, make note of the readings of the corresponding sensors.
3. The LTX311 has factory preset alarm settings that are consistent with MSHA guidelines and units will alarm when these limits are exceeded. Alarm limits are resettable and the unit will alarm at other user chosen values.
4. Refer to the instruction manual for further operating and calibration instructions.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
ATX612 MULTI-GAS ASPIRATED MONITOR

**Checking the instrument:**

1. Turn the instrument on by pressing the ON OFF MODE Button and holding until "RELEASE" appears on the display. The ON OFF MODE key is located on the faceplate of the instrument. (Do this prior to the start of the clock for working contest problems.) ***NOTE:*** *If the ON OFF MODE Button is released prior to the completion of the 5 second delay, the instrument start up will be aborted and the ATX612 will turn off.*
2. Visually check the instrument for any damage.
3. After turning the instrument on, the unit goes through a warm-up sequence in which the pump starts, the display is completely activated and then the installed sensors are displayed. The ATX612 is capable of various sensor configurations. Operators can choose from Oxygen, LEL or Methane, and any two of the following toxic gases; Carbon Monoxide, Hydrogen Sulfide, Sulfur Dioxide, Nitrogen Dioxide and Chlorine.
4. When the instrument completes the warm-up sequence it will display the current concentration of gas of the installed sensors. In clean air, the following content of gas

should be observed: Oxygen is approximately 20.9% +/- 0.1%. The Methane display should read -0.1, 0.0 or 0.1%. The toxic gas should read -001, 000, 001 PPM for Carbon Monoxide, Hydrogen Sulfide, and Hydrogen Cyanide and -00.1, 00.0, 00.1 for Nitrogen Dioxide and Sulfur Dioxide.

5. Check the battery condition by observing the asterisk on the display, which indicates battery life. Each segment represents approximately one hour of instrument run time.

**Testing for hazardous gases:**

1. Make sure the instrument is turned on and functioning properly. Be certain that the sample inlet is not obstructed. Place the instrument in the area to be monitored.
2. The ATX612 will display up to four gases simultaneously. Once the gas readings have stabilized, make note of the readings of the corresponding sensors.
3. The ATX612 has factory preset alarm settings that are consistent with MSHA guidelines and units will alarm when these limits are exceeded. Alarm limits are resettable and the unit will alarm at other user chosen values.
4. Refer to the instruction manual for further operating and calibration instructions.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
ATX620 MULTI-GAS ASPIRATED MONITOR

**Checking the instrument:**

1. Turn the instrument on by pressing the ON OFF MODE Button and holding until "RELEASE" appears on the display. The ON OFF MODE key is located on the faceplate of the instrument. (Do this prior to the start of the clock for working contest problems.) ***NOTE:*** *If the ON OFF MODE Button is released prior to the completion of the 5 second delay, the instrument start up will be aborted and the ATX620 will turn off.*
2. Visually check the instrument for any damage.
3. After turning the instrument on, the unit goes through a warm-up sequence in which the pump starts, the display is completely activated and then the installed sensors are displayed. The ATX620 is capable of various sensor configurations. Operators can choose from Oxygen, Infra-red Carbon Dioxide or Methane, LEL Combustible and one of the following toxic gases; Carbon Monoxide, Hydrogen Sulfide, Sulfur Dioxide, Nitrogen Dioxide and Chlorine. Along with the Infrared benefit of either the Carbon Dioxide or Methane sensor, this instrument provides an extended range on the Carbon Monoxide sensor which allows readings up to 20,000 PPM (2%) Carbon Monoxide.

4. When the instrument completes the warm-up sequence it will display the current concentration of gas of the installed sensors. In clean air, the following content of gas should be observed: Oxygen is approximately 20.9% +/- 0.1%. The Methane display should read -0.1, 0.0 or 0.1%. The toxic gas should read -001, 000, 001 PPM for Carbon Monoxide, Hydrogen Sulfide, and Hydrogen Cyanide and -00.1, 00.0, 00.1 for Nitrogen Dioxide and Sulfur Dioxide.
5. Check the battery condition by observing the asterisk on the display, which indicates battery life. Each segment represents approximately one hour of instrument run time.

**Testing for hazardous gases:**

1. Make sure the instrument is turned on and functioning properly. Be certain that the sample inlet is not obstructed. Place the instrument in the area to be monitored.
2. The ATX620 will display up to four gases simultaneously. Once the gas readings have stabilized, make note of the readings of the corresponding sensors.
3. The ATX620 has factory preset alarm settings that are consistent with MSHA guidelines and units will alarm when these limits are exceeded. Alarm limits are resettable and the unit will alarm at other user chosen values. Refer to the instruction manual for further operating and calibration instructions.





INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
T80 SINGLE GAS MONITOR

**Checking the instrument:**

1. Turn the instrument on by pressing and holding the Function Switch, located on the side of the instrument. When first pressed, the display will indicate "ON" and the instrument will beep once per second. After 5 seconds, all the display segments will illuminate at which time the function switch may be released. (Do this prior to the start of the clock for working contest problems.) ***NOTE:** If the function switch is released prior to the completion of the 5 second delay, the instrument start up will be aborted and the T80 will turn off.*
2. Visually check the instrument for any damage.
3. After turning the instrument on, the unit goes through a warm-up sequence in which the display is completely activated and then the installed sensor is displayed along with other test functions. The T80 is capable of various sensor configurations. Operators can choose from Oxygen, Carbon Monoxide, Hydrogen Sulfide, Sulfur Dioxide, Nitrogen Dioxide and Hydrogen Cyanide.
4. When the instrument completes the warm-up sequence it will display the current concentration of gas of the installed sensor. In clean air, the following content of gas should be observed: Oxygen is approximately 20.9% +/-

0.1%. The toxic gas should read -001, 000, 001 PPM for Carbon Monoxide, Hydrogen Sulfide, and Chlorine and -00.1, 00.0, 00.1 for Nitrogen Dioxide and Sulfur Dioxide.

5. Check the battery condition by observing the rows of bars on the display, which indicates battery life. Three rows of bars indicate “good” battery condition. Two rows of bars indicate approximately 75 hours or less of operation. If a single row of bars is displayed, the battery should be replaced immediately.

**Testing for hazardous gases:**

1. Make sure the instrument is turned on and functioning properly. Place the instrument in the area to be monitored.
2. The T80 will display one gas – that of the installed sensor. Once the gas reading has stabilized, make note of the reading.
3. The T80 has factory preset alarm settings that are consistent with MSHA guidelines and units will alarm when these limits are exceeded. Alarm limits are reset-able and the unit will alarm at other user chosen values.
4. Refer to the instruction manual for further operating and calibration instructions.



INDUSTRIAL SCIENTIFIC CORPORATION (ISC)  
CD211 METHANE DETECTOR

**Preliminary Check:**

1. Check for proper Zero. Press and hold the check switch on the upper right side of the case. When activated, the CD211 should always go through a warm-up cycle that is apparent as a rapidly changing sequence of readings on the display. Within 10 seconds the sensor should reach equilibrium and the reading should settle on a stable "0.0". An instrument that does not go through this warm-up cycle should be tested for correct operation. An instrument that does not indicate "0.0" needs to be calibrated. A display blank may indicate instrument malfunction. Refer to the instrument instruction manual for setting the zero and calibration instructions.
2. Visually check the instrument for any damage. Be certain the sampling port on the rear of the instrument is clean and free of any obstructions.
3. Low battery condition is indicated by the "LO BATT" indicator. When this indicator lights, there are less than 10 one minute checks remaining.

**Testing for hazardous gases:**

1. While depressing the check switch, expose the instrument to the area to be monitored for combustible gas. If gas is present, the display will indicate the concentration and display the result in % gas by volume. This takes 3-5 seconds. Note the reading and release the button.



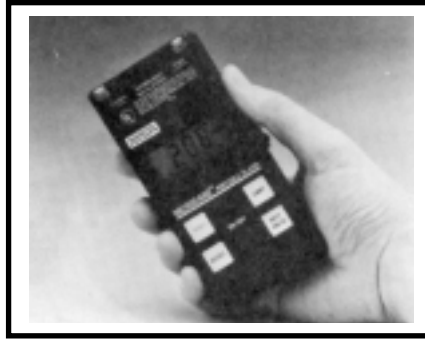
MINE SAFETY APPLIANCES COMPANY (MSA)  
THE KWIK-DRAW MULTI-GAS DETECTOR

**Preliminary checks:**

The pump should be checked for airtightness before each use. This is done by closing the suction opening of the pump with an unopened tube and compressing the bellows. If the bellows has not opened in 1 minute, the pump is airtight.

**Operation:**

Break off both ends of the MSA tube in the tube breaker near the pump inlet. Insert the tube tightly in the pump head with the arrow pointing toward the pump. Compress the pump until the stroke counter advances to the next number. The stroke is completed when the end of the stroke indicator changes from yellow to black.



MINE SAFETY APPLIANCES COMPANY (MSA)  
MICROGARD MULTI-GAS DETECTOR

**Preliminary checks:**

1. These checks should be made in fresh air. Press the “ON/OFF” button to turn the instrument on. Wait approximately 15 seconds for the instrument to stabilize and for the alarms to clear. Press the “RESET” button to clear the alarm.
2. Press and hold the “BATTERY VOLTS” button for approximately five seconds. The battery reading should be 2.3 volts or higher. Recharge or replace batteries in fresh air if battery reading is below 2.3 volts.
3. Press the “SELECT” button until the LCD shows the percent  $\text{CH}_4$ . The number should be zero plus or minus 0.2. If it is not zero, adjust “Z” potentiometer next to the “ $\text{CH}_4$ ” mark. This is located on the right side of the instrument behind a small gasketed protective cover.
4. Press the “SELECT” button until the LCD shows percent oxygen. This reading should be 20.8% oxygen. If the reading needs to be adjusted the “S” potentiometer next to the “OXY” on the side of the instrument is used.

**Operation:**

1. Leave the instrument on. Gas tests can now be made. Both gas alarms are functional regardless of what is displayed.

2. The instruction manual should be consulted for operating, calibrating or servicing details.



MINE SAFETY APPLIANCES COMPANY (MSA)  
PASSPORT MULTI-GAS DETECTOR

#### **Preliminary checks**

1. These checks should be made in fresh air. Press the “ON/OFF” button to turn the instrument on.
2. A request for “Fresh Air Setup” will appear on the display. Within five seconds press the “Page” button to activate the fresh air setup to function. This will automatically set the oxygen readout to 20.8% oxygen and zero the carbon monoxide and methane sensors. When the fresh air setup is complete the gases will be displayed.
3. The “Reset” button can be used to clear alarm conditions. Pressing any button will activate the back light.
4. The “Page” button can be used to scroll through other pages of information. All gas alarms are functioning regardless of the meter display.

#### **Operation:**

1. Leave the instrument on. Gas tests can now be made.

2. The instruction manual should be consulted for operating, calibrating or servicing details.





MINE SAFETY APPLIANCES COMPANY (MSA)  
NEW AND IMPROVED MULTI-GAS DETECTOR  
PASSPORT® FIVESTAR

#### **Preliminary checks**

1. These checks should be made in fresh air. Press the “ON/OFF” button to turn the instrument on.
2. A request for “Fresh Air Setup” will appear on the display. Within five seconds, press the “Page” button to activate the fresh air setup to function. This will automatically set the oxygen readout to 20.8% oxygen and zero the carbon monoxide and methane sensors. When the fresh air setup is complete, the gases will be displayed.
3. The “Reset” button can be used to clear alarm conditions. Pressing any button will activate the back light.
4. Press the “Reset” button for 3 seconds to enter into autocal.
5. The “Page” button can be used to scroll through other pages of information. All gas alarms are functioning regardless of the meter display.
6. Press the “Page” button to display battery charge and remaining run time of instrument in hours and minutes.

**Operation:**

1. Leave the instrument on. Gas tests can now be made.
2. The instruction manual should be consulted for operating, calibrating or servicing details.



MINE SAFETY APPLIANCES COMPANY (MSA)  
SINGLE GAS MONITOR  
CARBON MONOXIDE/HYDROGEN SULFIDE/OXYGEN

**Cricket® Personal Alarms**

1. Once Activated — Never Turn Off
2. Test Button for Audio and Visual Alarms

**Operation**

1. Two Audio Levels — Warning and Alarm
2. “High” Pitch Chirping Sound when Exposed to Gas
3. Automatic Reset when in Safe Atmosphere



MINE SAFETY APPLIANCES COMPANY (MSA)  
VENTILATION SMOKE TUBES

Hermetically Sealed — Ready for Use  
Generates Visual Smoke to Check or Measure Air Currents

**Operation**

Last for 8 hrs. — Normal Day

**Plastic**

1. Crush Ampoles (Enclosed in Plastic Tube)
2. Attach to Aspirator Bulb
3. Squeeze Bulb to Generate Smoke

**Glass**

1. Break Both Ends of Tube
2. Attach to Aspirator Bulb
3. Squeeze Bulb to Generate Smoke

